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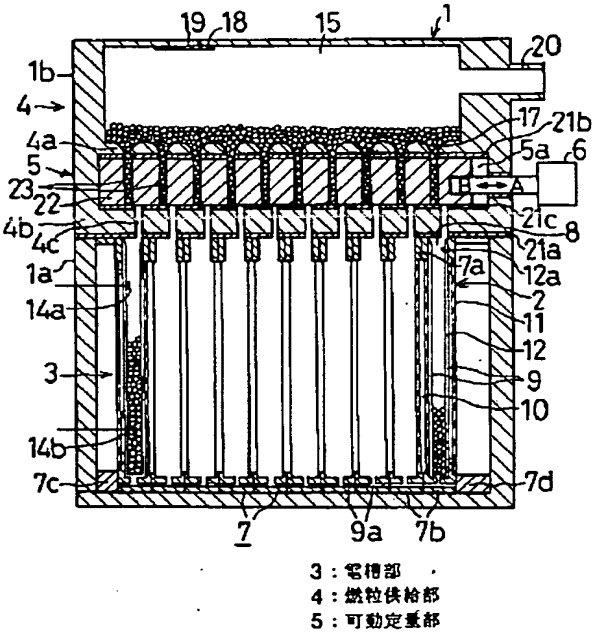
(54)【発明の名称】　金属－空気電池

(57)【要約】

【目的】電槽部に上設した燃料容器部から燃料を落下させる可動定量部への燃料供給の連続性を確実に行うことを目的とする。

【構成】複数単セル２からなる電槽部３と各単セル２に対応した燃料落下孔１７を有した燃料容器部４との間に摺動可能に可動定量部５が介装され、該可動定量部５と各電槽部３及び燃料容器部４との各摺動面を形成する部分に、絶縁性の固体潤滑膜２１ａ～２１ｃ又はゴム弾性材料を設けたこと。



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【特許請求の範囲】

【請求項1】空気極と該空気極と所定間隔を隔てて対向する多孔壁とを具備し、該空気極と該多孔壁との間に形成され、電解液を保持する電解液室と該空気極で該電解液室と区画された空気室と該多孔壁で該電解液室と区画され上部に取入口を有し、該取入口より供給される粒状金属燃料を収納する金属極とをもつ単セルを複数個形成する電槽部と、

該電槽部に上設され、前記各燃料取入口に対応する複数の燃料落下孔を有し該粒状金属燃料を保持する燃料容器部と、

該燃料容器部と電槽部との間に設けられ、上部に前記各燃料落下路に連通する開口と下部に前記各燃料取入口に連通する開口を有する前記粒状金属燃料を定量保持する小室があり、該小室を前記燃料落下路及び前記燃料取入口と同時もしくは交互に連通させた状態と遮断させた状態とに変位する可動定量部とを具備し、

該可動定量部と前記燃料容器部及び電槽部との両摺動面の少なくとも一面を形成する部分は、絶縁性の固体潤滑膜又はゴム弾性材料で形成されていることを特徴とする金属－空気電池。

【請求項2】空気極と該空気極と所定間隔を隔てて対向する多孔壁とを具備し、該空気極と該多孔壁との間に形成され、電解液を保持する電解液室と該空気極で該電解液室と区画された空気室と該多孔壁で該電解液室と区画され上部に取入口を有し、該取入口より供給される粒状金属燃料を収納する金属極とをもつ単セルを複数個形成する電槽部と、

該電槽部に上設され前記燃料取入口に対応する燃料落下路を前記燃料取入口に対し連通させた状態と遮断した状態に相対摺動する燃料容器部とを具備し、

該電槽部及び燃料容器部の両摺動面の少なくとも一面を形成する部分は、絶縁性の固体潤滑膜又はゴム弾性材料で形成されていることを特徴とする金属－空気電池。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は、電気自動車駆動用電源等に用いられる金属－空気電池に関する。

【0002】

【従来の技術】金属－空気電池は、空気極での酸素の還元と金属極での金属の溶解とを組み合わせて発電を行う一種の一次電池であり、金属極には、アルミ、鉄、亜鉛等が用いられる。図9は金属極にアルミを使用した金属－空気電池の発電原理を示しており、空気極には板状のカーボンが用いられ、該空気極は一面が撥水膜を介して空気と接し、他面が電解液に浸漬している。金属極は、アルカリ金属水酸化物に属するＫＯＨの電解液に浸漬されている。

【0003】そして、空気極では

$3/4O_2 + 3/2H_2O + 3e^- \rightarrow 3OH^-$

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の反応が起こり、金属極では

$Al + 3OH^- \rightarrow Al(OH)_3 + 3e^-$

の反応が起きる。従って、全反応は、

$Al + 3/2H_2O + 3/4O_2 \rightarrow Al(OH)_3 \downarrow$

となり、沈澱物Ａｌ（ＯＨ）$_3$が残る。

【0004】このような電池反応を持続し燃料電池として使用するため、電解液を循環することによって沈澱物を除去し、金属極を容器状多孔性導電物質とその中に連続的に供給される粒状金属燃料とで構成した金属－空気電池が例えばＰＣＴ／ＦＲ９１／００９４４号刊行物に開示されている。同刊行物には、燃料取入口を上方に開設した多孔導電性ホルダ及びその中の粒状金属燃料から構成される金属極を、対向する板状の空気極によって形成される電解液空間に在したセルの電槽部に対し、底孔をもつ燃料容器部を上設し、該セルと燃料容器部との間に燃料を一定量ごとセルに供給する可動定量部を介装させたものが開示されている。具体的に、可動定量部は、図１０に示すように、燃料容器部ａからの定量の燃料を一時的に保持する小室ｂをもつ定量板ｃと、燃料容器部ａの底部と上記定量板ｃとの間で往復摺動可能に介在し、上記燃料容器部ａの底孔ａ１と上記定量板ｃの小室ｂとを連通する孔ｄ１を有した上仕切板ｄと、上記定量板ｃとセルｅの燃料取入口ｆが臨む上面との間に往復摺動可能に介在し、上記定量板ｃの小室ｂとセルｅの燃料取入口ｆとを連通する孔ｇ１を有した下仕切板ｇとからなっている。

【0005】従って、定量板ｃの小室ｂには上仕切板ｄの摺動によって燃料容器部ａの底孔と小室ｂとが連通して定量の燃料が小室ｂに落下し保持され、セルｅ内の燃料が少なくなると、下仕切板ｇの摺動によって、小室ｂとセルｅの燃料取入口ｆとが連通し小室ｂに保持された燃料がセルｅに落下して金属極ｈに補給される。小室ｂの燃料が金属極ｈに補給されると下仕切板ｇの摺動により小室ｂとセルｅの燃料取入口ｆとを遮断した後、再び上仕切板ｄを摺動して燃料容器部ａの燃料を小室ｂに保持し、次期燃料補給に備える。このように上仕切板ｄと下仕切板ｇとの交互の往復摺動によって、金属極ｈには連続的に定量の燃料が供給されることになる。

【0006】

【発明が解決しようとする課題】従来の金属－空気電池における燃料供給構造は、燃料容器部と定量板との間で上仕切板が摺動し、定量板と電槽部との間で下仕切板が摺動する形態であり、両摺動面には、電解液や水蒸気等が外部に漏洩しないシール機能と、各仕切板の円滑な摺動性が要求される。

【0007】しかしながら、上記従来の燃料供給構造は、単に油脂ｉを介在させただけであり、上述したようなシール機能や摺動性に考慮がなされていない。従って、電解液や水蒸気等が外部に漏洩するおそれがあるとともに、熱膨張、電解液の浸入、摺動面の静電気力、湿

気による吸着、摺動面のキズ等によって、アルミ粉末が摺動面に付着するおそれがある。その結果、円滑な摺動が損なわれ、燃料供給の連続性が損なわれてしまう。

【０００８】また、同燃料供給構造では、例えば上仕切板ｃが摺動するとき、燃料容器部ａにおける底孔ａ１の下エッジａ′と上仕切板ｄにおける孔ｄ１の上エッジｄ′との間又は小室ｂの上エッジｂ′との間で粒状金属燃料を挟み、上仕切板ｄがロックしてしまうことが考えられる。この原因は、主に摺動面の汚れによって粒状金属燃料がその部分に付着することによるものである。このように仕切板がロックしてしまうと、燃料が過剰に供給されたり、反対に不足して安定した出力が得られなくなる。

【０００９】本発明は、燃料を定量的に連続供給するために摺動する可動定量部における摺動面のシール機能と円滑な摺動性を図るとともに、該摺動面での粒状金属燃料によるロック現象を防止し、燃料を確実に定量的連続的に供給して安定した出力を発生させることを解決すべき課題とする。

【００１０】

【課題を解決するための手段】本発明は、空気極と該空気極と所定間隔を隔てて対向する多孔壁とを具備し、該空気極と該多孔壁との間に形成され、電解液を保持する電解液室と該空気極で該電解液室と区画された空気室と該多孔壁で該電解液室と区画され上部に取入口を有し、該取入口より供給される粒状金属燃料を収納する金属極とをもつ単セルを複数個形成する電槽部と、該電槽部に上設され、前記各燃料取入口に対応する複数の燃料落下孔を有し該粒状金属燃料を保持する燃料容器部と、該燃料容器部と電槽部との間に設けられ、上部に前記各燃料落下路に連通する開口と下部に前記各燃料取入口に連通する開口を有する前記粒状金属燃料を定量保持する小室があり、該小室を前記燃料落下路及び前記燃料取入口と同時もしくは交互に連通させた状態と遮断させた状態とに変位する可動定量部とを具備し、更に、可動定量部と前記燃料容器部及び電槽部との両摺動面の少なくとも一面を形成する部分は、絶縁性の固体潤滑膜又はゴム弾性材料で形成されているものである。

【００１１】好適な態様として、固体潤滑膜とゴム弾性材料を併用し、両摺動面の一面に固体潤滑膜を形成し、他面を形成する部分はゴム弾性材料で形成される。

【００１２】

【作用】上記構成の金属－空気電池は、駆動手段を作動すると、該燃料容器部と電槽部との間に設けられた可動定量部が、燃料容器部と電槽部との間で摺動して、粒状金属燃料を各単セルの金属極に供給する。そして、可動定量部と前記燃料容器部及び電槽部との両摺動面の少なくとも一面を形成する部分に絶縁性の固体潤滑膜が形成されるものであるから、粒状金属燃料の付着が確実に防止されるとともに、電解液や水蒸気等の漏洩を防止できる。その結果、摺動性が良好となって、燃料供給の連続性が達成される。

【００１３】また、ゴム弾性材料の場合は、粒状金属燃料がゴム弾性材料の弾性変形によってゴム弾性材料の表層部に埋没し、摺動性を確保して、ロック現象を防止することができる。固体潤滑膜とゴム弾性材料を併用する場合は、ロック現象の防止とともに一層の摺動性を発揮する。

【００１４】

【実施例】以下、本発明を図示の実施例によって詳細に説明する。

実施例１

図１及び図２は本発明の第１実施例に係る金属－空気電池を示す。本第１実施例の金属－空気電池は、セラミック等で箱形に形成された下外容器１ａ内に設置され単セル２を複数形成した電槽部３と、上外容器１ｂに構成された燃料容器部４と、上外容器１ｂの下側に構成した可動定量部５と、該可動定量部５を駆動する一つの駆動手段６とから構成されている。

【００１５】電槽部３は、外容器１の縦方向（紙面に垂直な方向）に並設された複数単セル２の集合体である。各単セル２は、フレーム７を母体に構成される。フレーム７は、横方向の対向する面が開口し、上カイド７ａ，下ガイド７ｂ及び縦方向に対向する側ガイド（図略）をもつ四辺形枠体である。上ガイド７ａには、縦方向にスリット状の開口８が形成される。下ガイド７ｂには、電解液通路用空間が形成されている。各フレーム７には、横方向の対向面にそれぞれ板状の空気極１１，１１が接着等の手段によって液密に固着される。これら空気極１１とフレーム７とによってセル空間が形成され、該各セル空間内に上記開口８と燃料取入口１２ａとが連通するように容器状の金属極１２が上ガイド７ａに懸架される。電解液室９は、金属極１２と各空気極１１との空間に形成され、この電解液室９が下ガイド７ｂにおける電解液通路用空間と連通することにより、該電解液通路用空間は各単セル２の電解液室９を連通する電解液通路９ａとなっている。この電解液通路９ａに図外の外部循環手段によって電解液を供給し、電解液を循環できるようになっている。空気室１０は、隣接する単セル２の各空気極１１が対接した空間によって形成される。このような電槽部３の構成は、同時に出願した事務所整理番号Ｐ０００００５６７０に詳細に説明されている。

【００１６】なお、上記単セル２の構造は、既述のごとく金属極１２を両側から空気極１１で挟んだ構造でなくとも、一方は単に電解液を仕切るだけの多孔壁であってもよい。また、空気極１１はカーボン等によって形成されている。金属極１２は、電解液が浸透可能な多孔質導電性材料を容器状に作製され、電解液に対し耐腐食性の金属、例えばニッケル，ステンレス，ニッケルメッキした鉄などによって構成され、空気極１１間の縦方向に壁

状に位置している。そして、金属極１２には、上記燃料取入口１２ａを介して燃料容器部４から０．１～１．０mm径の金属燃料、例えばアルミ燃料が供給されるようになっている。

【００１７】なお、特定した一つの金属極１２の内側には、アルミ燃料の量をセンシングする一対の導体片１４ａ，１４ｂによる燃料検出器が設けられているが、同燃料検出器の説明も上記出願に詳細に開示されている。次に、上外容器１ｂの上側には、簀の子状底部４ａを板状に配設して燃料室１５を区画形成した燃料容器部４が形成されている。該簀の子状底部４ａには、燃料室１５側への上部開口と可動定量部５側への下部開口とが連通した縦方向にスリット状の燃料落下孔１７が形成される。該燃料落下孔１７は、上部開口が断面逆台形状に拡大し、下部開口側へは細径に絞られ、アルミ燃料が細径の部分に落下しやすくなっているとともに、電槽部３の燃料取入口１２ａに対し位相が半ピッチずれている。また、上外容器１ｂの天井には金網１８が貼設されたガス抜き孔１９が形成されるとともに、アルミ燃料を燃料室１５に補給するための燃料供給口２０が開設されている。

【００１８】また、上記簀の子状底部４ａの下側には、電槽部３と対接する仕切底部４ｂによってスライド室５ａを区画形成し、該スライド室５ａに定量板２２を内挿してなる可動定量部５が形成されている。仕切底部４ｂには、下部開口を単セル２の燃料取入口１２ａと位相を一致され（正しくは燃料取入口１２ａの右端に寄った位相とされ）、アルミ燃料を燃料取入口１２ａに導く燃料導孔４ｃが形成されている。この燃料導孔４ｃの上部開口はスライド室５ａへ連通している。

【００１９】スライド室５ａに内挿された定量板２２は、該スライド内で横方向に往復動自在とされている。該定量板２２には、上下開口が連通し、該定量板２２の往復動によって燃料落下孔１７及び燃料導孔４ｃを介して各単セル２の燃料取入口１２ａに連通可能で、アルミ燃料を定量保持する小室２３が形成されている。定量板２２を往復動させる駆動手段６は、例えば直動式のモータが用いられ、その出力軸６ａが上外容器１ｂの側部を貫通して定量板２２に接続されている。

【００２０】ここで、上外容器１ｂの底面には、電解液や水蒸気等を上外容器１ｂと下外容器１ａの接合面を通じて外部へ漏洩させないために、窒化ホウ素粉末、ＰＴＦＥ粉末等の絶縁性の固体潤滑剤による膜２１ａが塗布又は噴霧により形成されている。また、定量板２２におけるスライド室５ａの上側内壁及び下側内壁との各摺接面には、それぞれ燃料落下孔１７及び燃料導孔４ｃの開口面を除き、上外容器１ｂの底面と同様の絶縁性の固体潤滑膜２１ｂ，２１ｃが形成されている。

【００２１】このように構成された第１実施例の金属－空気電池は、次のように動作する。空気極１１と金属極１２は、既述したような反応式によって電池の放電作用を行い、放電により金属極１２のアルミ燃料が消費される。そして、特定された金属極１２内のアルミ燃料が予め設定した燃料量より減少すると、定量板２２が駆動手段６によって復動（Ａ方向に移動）され、図２（Ｂ）に示す小室２３が燃料落下孔１７と連通した状態から、図２（Ａ）のように、小室２３が燃料導孔４ｃを介して燃料取入口１２ａに連通した状態に変位して、小室２３に保持した量のアルミ燃料を各金属極１２に供給する。定量板２２のこのような復動は、金属極１２内に設けた導体片１４ａ，１４ｂによって燃料の減少が検出されることをトリガとして、駆動手段６が作動指令されることによる。

【００２２】ところで、上記実施例では、定量板２２の上下摺動面に絶縁性の固体潤滑膜２１ｂ，２１ｃが形成されているため、摺動面へのアルミ燃料の付着が確実に防止されるとともに、電解液や水蒸気等の漏洩を防止できる。その結果、定量板２２の円滑な摺動性を確保するとともに、アルミの粒が小室２３の開口エッジや、燃料落下孔１７の開口エッジに付着することがなく、定量板２２のロック現象が防止される。　また、上外容器１ｂの底面に形成された絶縁性の固体潤滑膜２１ａは、電解液や水蒸気の外部への漏洩を防止する。かくして本実施例を採用する金属－空気電池は、安定な発電を行うことができる。なお、各外容器１ａ，１ｂを一体にする場合は、絶縁性の固体潤滑膜２１ａは省略してもよい。

【００２３】実施例２

図４は本発明の第２実施例に係る金属－空気電池を示す。この実施例は、単セル２の集合体である電槽部３を下外容器１ａ内に構成する点は第１実施例と同じであるが、可動定量部５を省略し、上外容器１ｂによって構成される燃料容器部４を直接に往復動させたものである。すなわち、上外容器１ｂの電槽部３と摺接する簀の子状底部４ａには各単セル２に対応して燃料落下孔１７が形成され、該簀の子状底部４ａと天井との間に燃料室１５が形成さてれいる。この場合、燃料の定量落下を確保する底部２の厚みを前実施例より大きくし、燃料落下孔１７の経路を長くしている。これにより、燃料落下孔１７は小室２３と同様な機能を果たす。

【００２４】そして、本実施例では、上記燃料容器部４の燃料落下孔１７を除く底面に、絶縁性の固体潤滑膜２１ｄが形成されている。従って、この実施例でも、摺動面へのアルミ燃料の付着が確実に防止され、燃料容器部４と電槽部３との摺動面の円滑な摺動性が確保されるとともに、該摺動面からの電解液や水蒸気の外部漏洩を防止できる。

【００２５】実施例３

図４及び図５は本発明の第３実施例に係る金属－空気電池を示す。この実施例は、外容器１は一体品であり、その下側に電槽部３を構成し、上側に燃料容器部４を構成

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したものである。そして、該燃料容器部４の簀の子状底部４ａは、電槽部３の上面に対しスライド室５ａの間隔を開けて形成され、該スライド室５ａに小室２３を有する定量板２２が内挿されている。本実施例の特徴は、小室２３の上下端開口を除く定量板２２の上下摺動面をそれぞれゴム等の弾性材料２４ａ，２４ｂでシールし、該上下摺動面に摺接するスライド室５ａの天床各摺動面に絶縁性の固体潤滑膜２１ｅ，２１ｆを形成したものである。

【００２６】なお、本実施例では、スライド室５ａは、外容器１の横方向対向側の一側から外部と連通し、定量板２２が抜き取り可能となっいる。なお、２５はストッパである。このような実施例によれば、燃料容器部絶縁性の固体潤滑膜２１ｅ，２１ｆにより、アルミ燃料の付着を防止できるとともに、電解液や水蒸気の外部漏洩を防止し、更に、図５に示すように、例えば小室２３の上端開口エッジと燃料落下孔１７の下端開口エッジがアルミ粒を挟んでも、該アルミ粒Ａｌがゴム弾性材料２４ａの弾性変形によってゴム弾性材料２４ａの表層部に埋没し、摺動性を悪化させることがなく、ロック現象を回避できる。

【００２７】実施例４

図６～図８に示す金属－燃料電池は、第１実施例の定量板２２をローラ形態としたものである。すなわち、この第４実施例は、燃料容器部４の簀の子状底部４ａと、各単セル２の母体となる複数のフレーム７を一体化した一体フレーム１６により、電槽部３及び燃料容器部４を一体形としたものである。そして、燃料落下孔１７に相当する燃料通路は、簀の子状底部４ａとなる部分と、上ガイド７ａとなる部分とにわたって、後述するローラ式の定量板２２を境にそれより上側の落下孔１７ａと、下側の落下孔１７ｂとで鉛直に形成され、落下孔１７ａの上端開口が燃料室１５に連通し、落下孔１７ｂの下端開口が各単セル２の燃料取入口１２ａに連通されている。

【００２８】各ローラ式の定量板２２は、落下孔１７ａ，１７ｂと連通自在で軸を通る割孔２３′を有した長尺円柱状をなし、落下孔１７ａ，１７ｂとの境に形成された縦方向の筒孔２６内に軸回転自在に介装されている。また、各ローラ式定量板２２は、図７に示すように、それぞれ各一端が外容器１の外側に突出し、突出したローラ部２２Ａには、駆動手段６の正逆回転出力軸６ａと固定ローラ２９に架設されたベルト６ｂにそれぞれ連結されている。これにより、ローラ式の定量板２２は、駆動手段６によって回転駆動される。

【００２９】さらに、本実施例の各ローラ式の定量板２

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２は、ゴム弾性材料にて形成されている。一方、上記筒孔２６のフレーム壁面には、絶縁性の固体潤滑膜２１ｇが形成されている。従って、上記第４実施例の場合、各ローラ式の定量板２２は、駆動手段６の回転動によって、落下孔１７ａ及び落下孔１７ｂに割孔２３′を一致させた状態と、図６に示すように、落下孔１７ａ及び落下孔１７ｂの燃料通路に対し割孔２３′が十字となる状態に変位させることができる。これにより、燃料消費に応じて各単セル２にアルミ燃料を連続的に供給することができる。

【００３０】また、本実施例は、図８に示すように、割孔２３′の開口エッジと落下孔１７ａ，１７ｂの開口エッジとがアルミ粒Ａｌを挟んでも、第３実施例と同様に、アルミ粒Ａｌはローラ式の定量板２２自体の弾性変形によってゴム弾性材料の表層部に埋没し、ロック現象を防止することができる。

【００３１】

【発明の効果】以上述べたように本発明によれば、電槽部と燃料容器部又は電槽部及び燃料容器部と可動定量部との摺動面を形成する部分に、絶縁性の固体潤滑膜又はゴム弾性材料を使用したので、粒状燃料の付着を防止するとともに、電解液や水蒸気等の漏洩を防止でき、その結果、可動定量部の摺動性が良好となって、燃料供給の連続性を確保する効果がある。また、ゴム弾性材料の弾性変形によってロック現象を回避することができるという効果がある。

【図面の簡単な説明】

【図１】本発明の第１実施例を示す構成図。

【図２】（Ａ）は第１実施例における燃料供給時の動作を示す説明図、（Ｂ）は同実施例における燃料遮断時の動作を示す説明図。

【図３】本発明の第２実施例を示す構成図。

【図４】本発明の第３実施例を示す構成図。

【図５】上記第３実施例の動作を示す説明図。

【図６】本発明の第４実施例を示す構成図。

【図７】上記第４実施例の正面図。

【図８】上記第４実施例の動作を示す説明図。

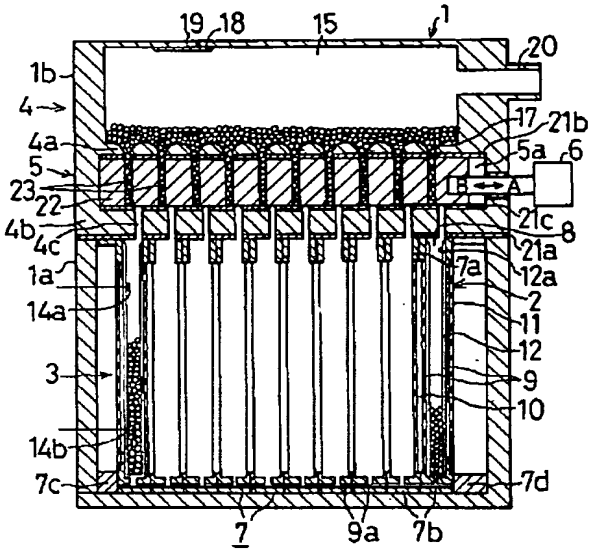
【図９】アルミ－空気電池の原理を説明する説明図。

【図１０】ロック現象を説明する説明図。

【符号の説明】

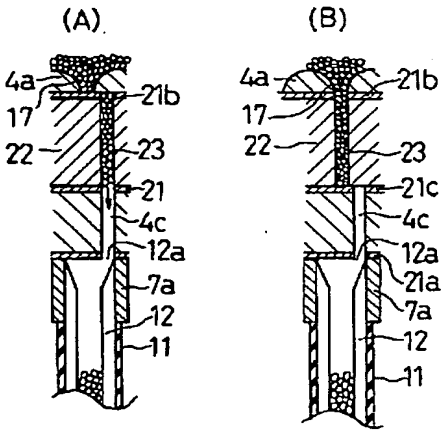
２…単セル、３…電槽部、４…燃料容器部、５…可動定量部、７…フレーム、９…電解液室、１０…空気室、１１…空気極、１２…金属極、１２ａ…燃料取入口、１５…燃料室、１７…燃料落下孔、２１ａ～２１ｃ…固体潤滑膜、２２…定量板、２４ａ，２４ｂ…ゴム弾性材料。

【図1】

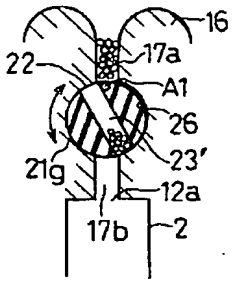


3：電極部
4：燃料供給部
5：可動定量部

【図2】



【図8】



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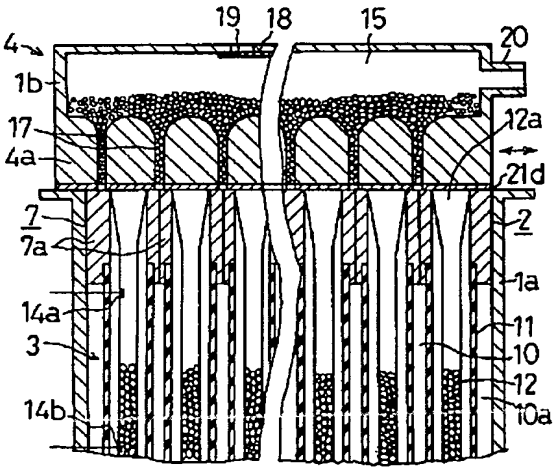
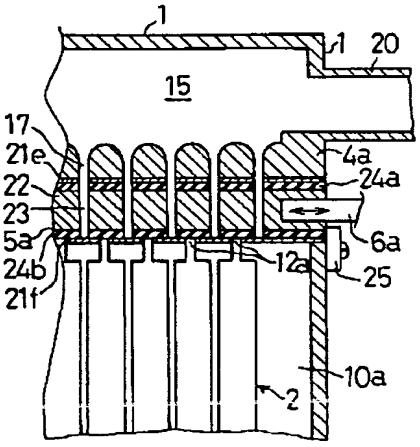


【図4】



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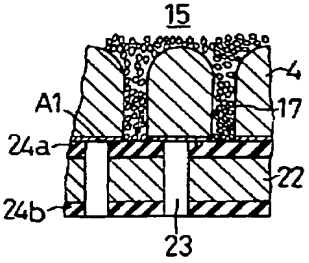
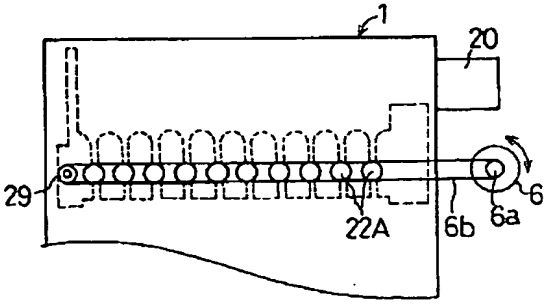


【図7】



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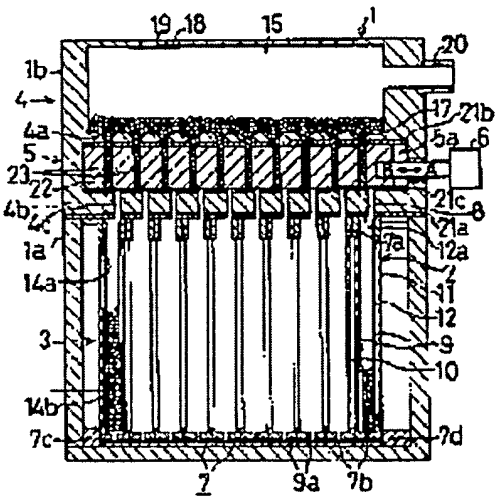
(72)Inventor : TOYODA TATSUO
NOMURA KAZUSHI
KUWABARA YASUO
INABA YUMI

(54) METAL-AIR BATTERY

(57)Abstract:
PURPOSE: To perform sure continuous supply of the fuel to a movable quantitative part, which makes the fuel drop from a fuel container part installed in the upper part of a battery jar part.
CONSTITUTION: A movable quantitative part 5 is interposed freely to slide between a battery jar part 3, which consists of plural unit cells 2, and a fuel container part 4 having fuel drop holes 17 corresponding to each unit cell 2. Each part of the movable quantitative part 5, which is formed with each sliding surface with each battery jar part 3 and fuel container 4, is provided with insulating solid lubricating films 21a-21c or an rubber elastic material.



LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

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[Date of registration]

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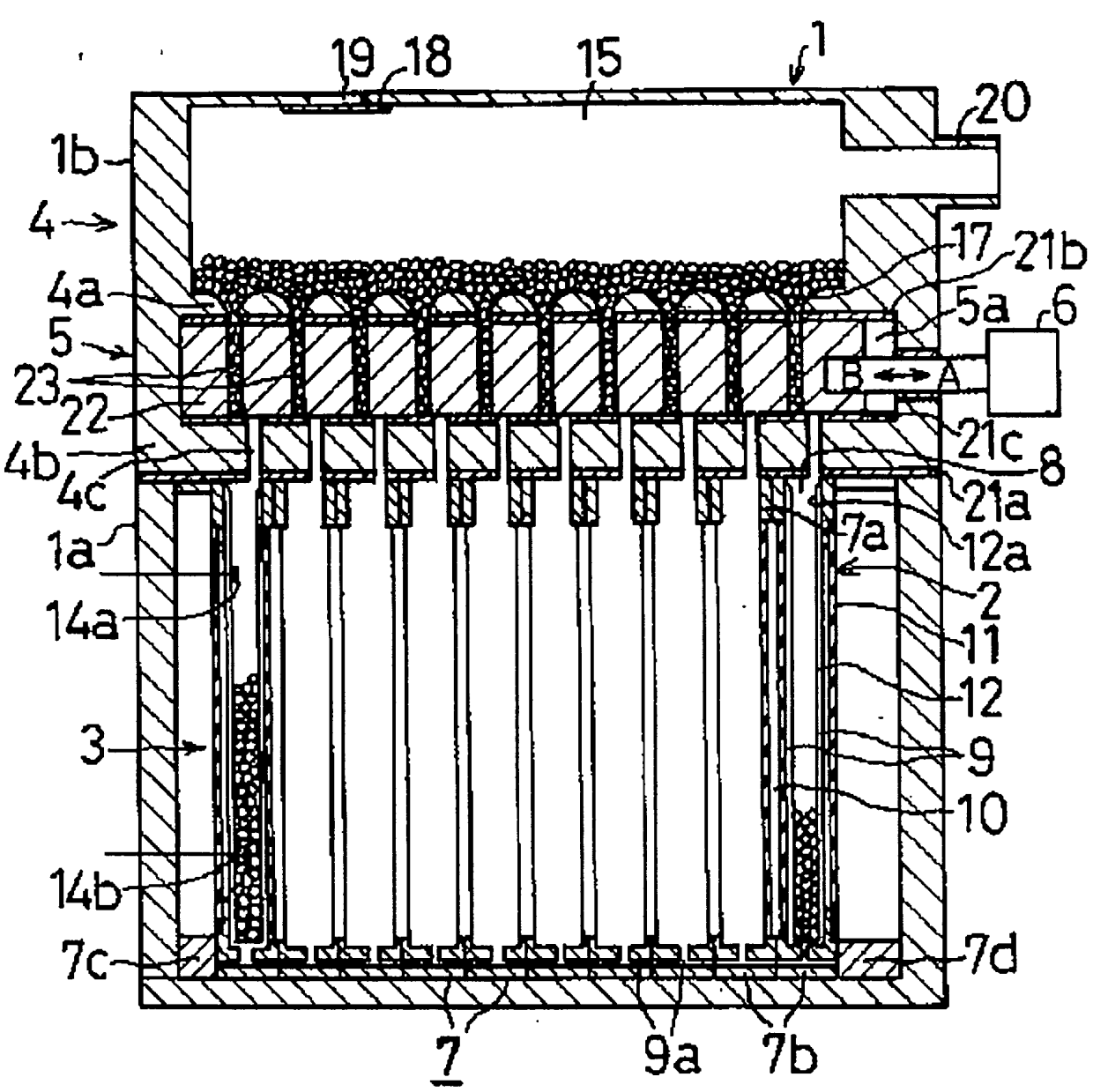
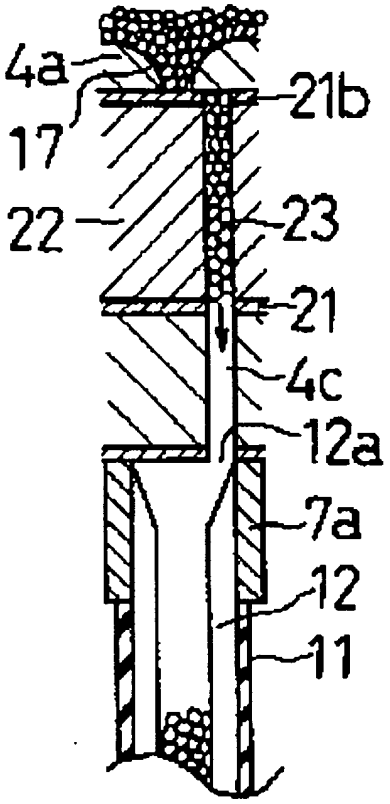


3：電槽部
4：燃粒供給部
5：可動定量部

(A)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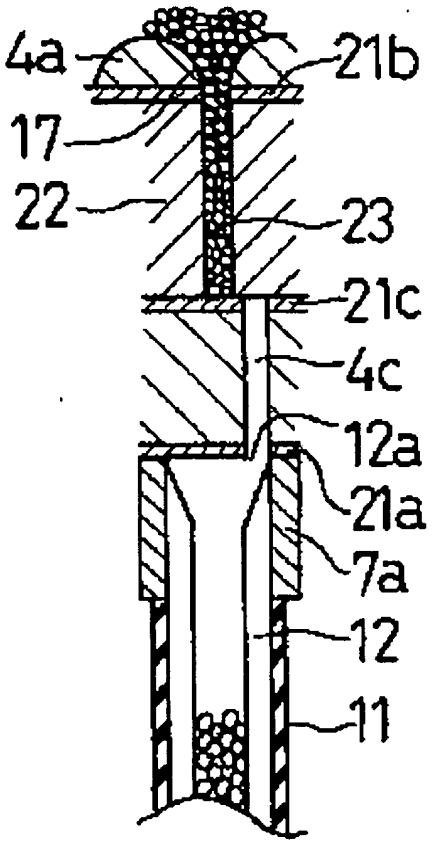
23
21
4c
12a
7a
12
11

(B)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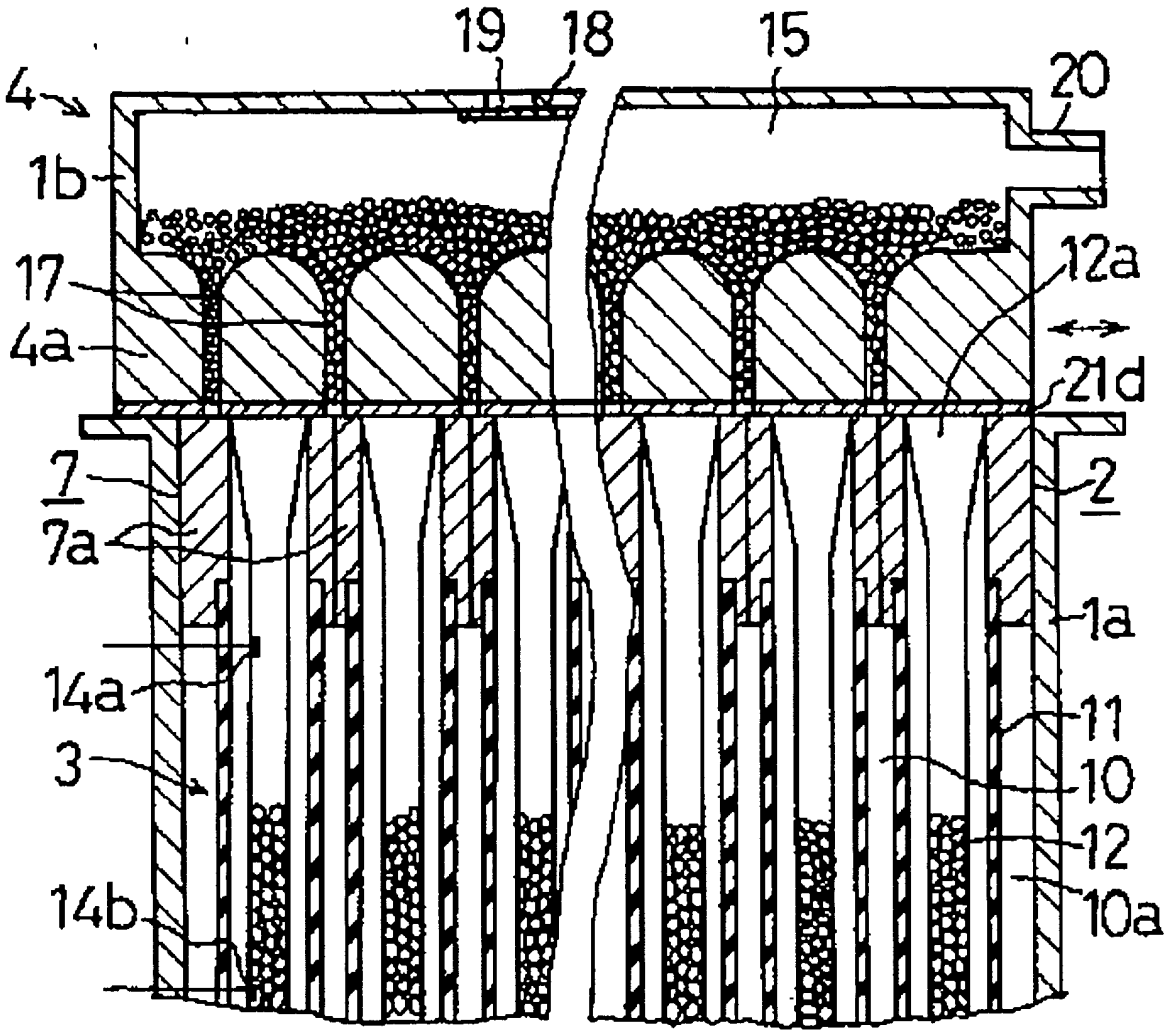
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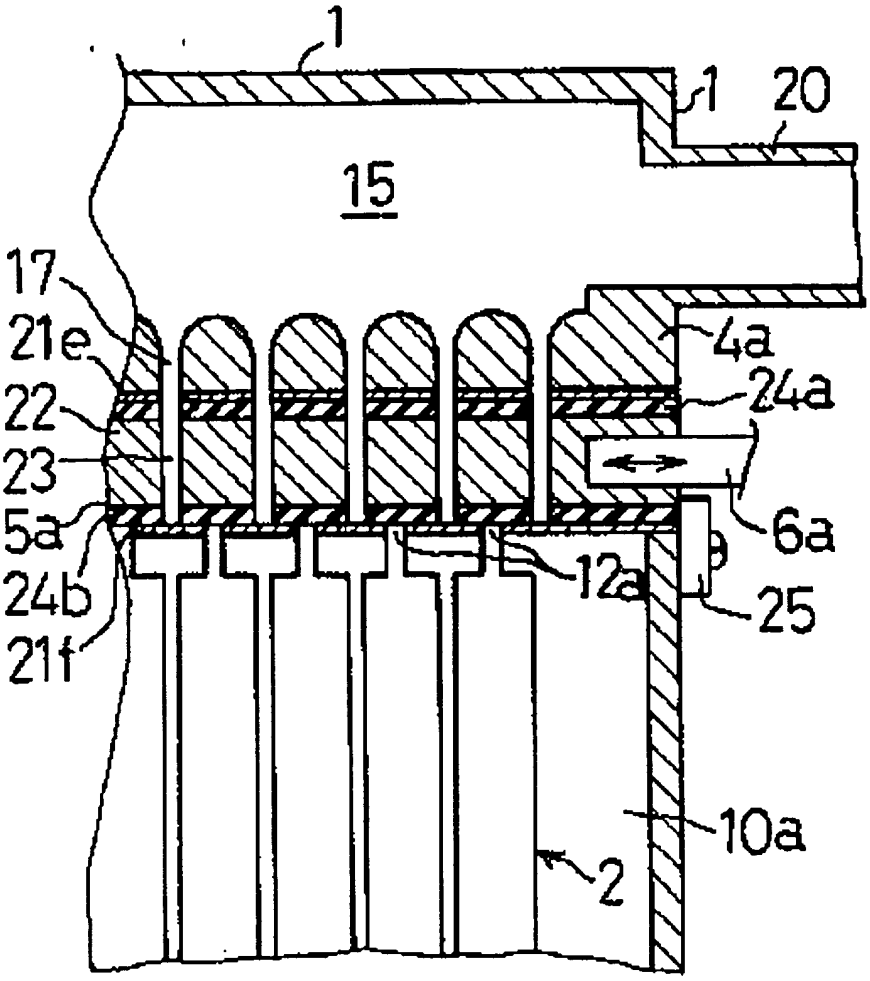
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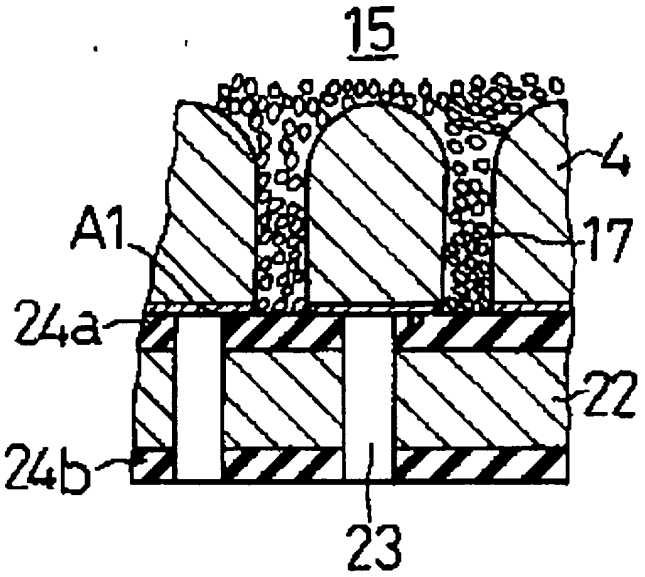
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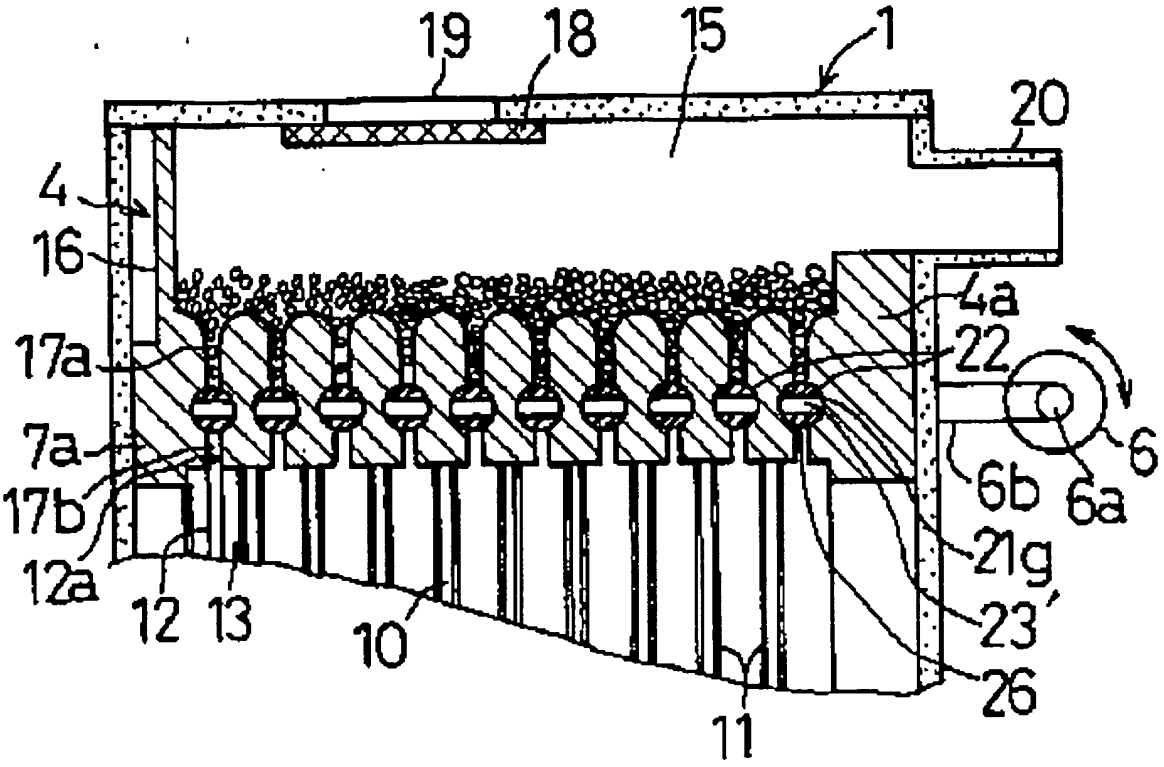
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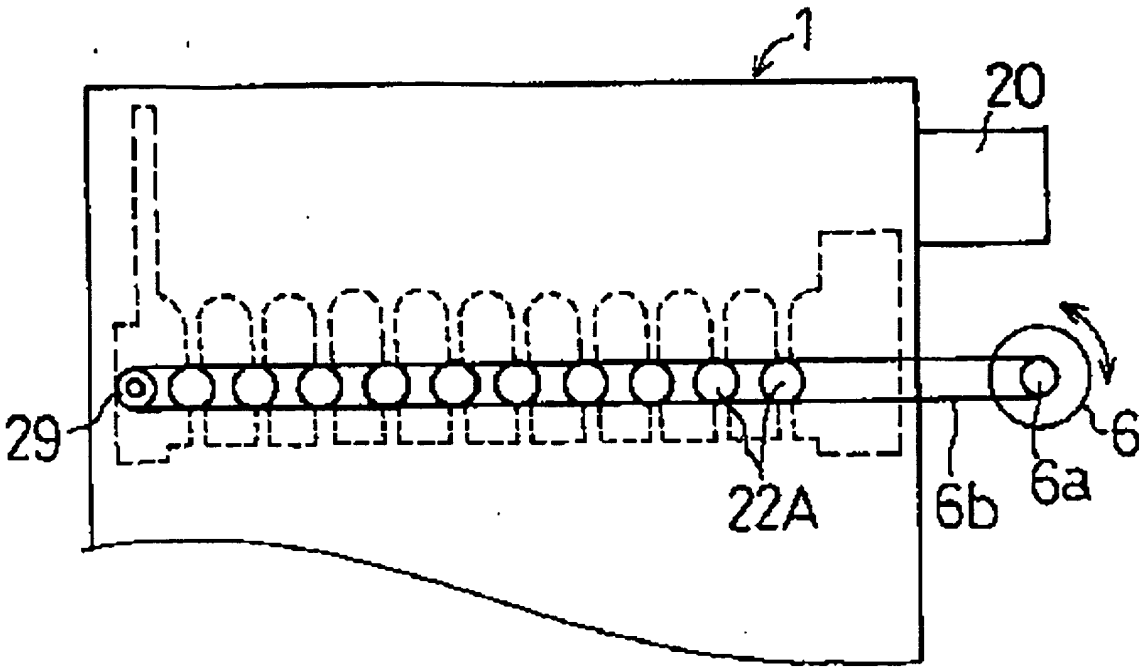
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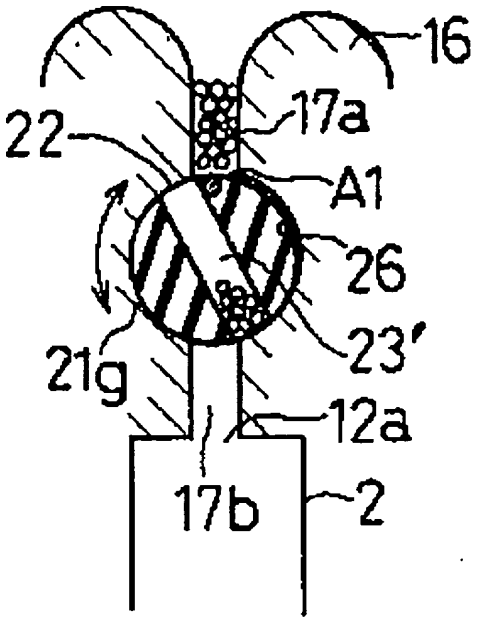
16
17a
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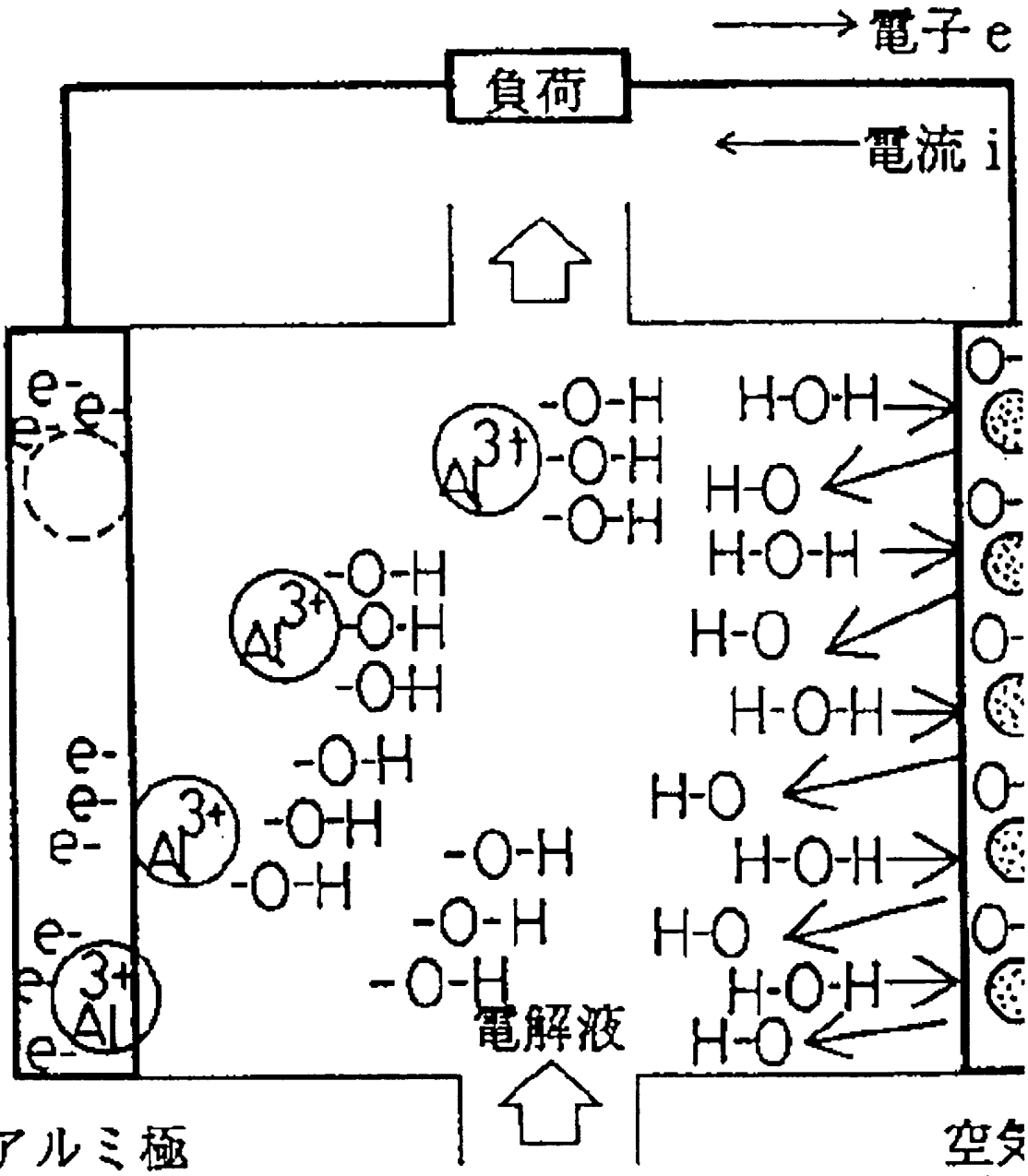
アルミ空気電池の原理



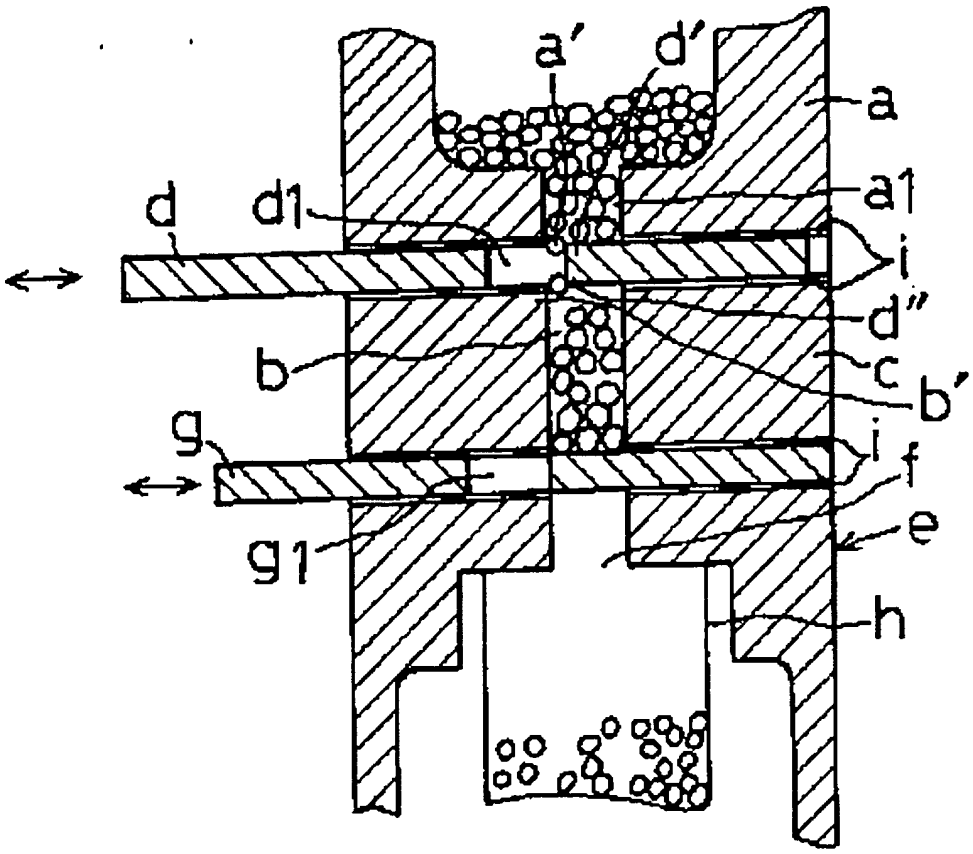
$Al + 3OH^- \rightarrow Al(OH)_3 + 3e^-$

$3/4O_2 + 3/2$

沈殿物

KOH

全反応 $Al + 3/2H_2O + 3/4O_2 \rightarrow Al(OH$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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The block diagram showing the 1st example of this invention.
[Drawing 2] For (A), (B) is the explanatory view showing the actuation at the time of the fuel supply in the 1st example, and the explanatory view showing the actuation at the time of the fuel shutoff in this example.
[Drawing 3] The block diagram showing the 2nd example of this invention.
[Drawing 4] The block diagram showing the 3rd example of this invention.
[Drawing 5] The explanatory view showing actuation of the 3rd example of the above.
[Drawing 6] The block diagram showing the 4th example of this invention.
[Drawing 7] The front view of the 4th example of the above.
[Drawing 8] The explanatory view showing actuation of the 4th example of the above.
[Drawing 9] The explanatory view explaining the principle of an aluminum-air cell.
[Drawing 10] The explanatory view explaining a lock phenomenon.
[Description of Notations]
2 [-- The movable quantum section, 7 / -- A frame, 9 / -- An electrolytic-solution room, 10 / -- An air chamber, 11 / -- An air pole, 12 / -- A metal pole, 12a / -- Fuel intake, 15 / -- A combustion chamber, 17 / -- A fuel fall hole, 21a-21c / -- Solid-state lubricating film, 22 / -- A quantum plate, 24a 24b / -- Rubber elasticity ingredient.] -- A single cel, 3 -- The battery case section, 4 -- The fuel container section, 5

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] The fuel-supply structure in the conventional metal-air cell is a gestalt on which an upper dashboard slides between the fuel container section and a quantum plate, and a bottom dashboard slides between a quantum plate and the battery case section, and the smooth sliding nature of each dashboard is required of both sliding surfaces as the seal function which neither the electrolytic solution nor a steam reveals outside.
[0007] However, consideration is made by neither a seal function whose above-mentioned conventional fuel-supply structure was made to only intervene, and mentioned fats and oils i above, nor sliding nature. Therefore, while there is a possibility that the electrolytic solution, a steam, etc. may be revealed outside, there is a possibility that aluminum powder may adhere to a sliding surface by the crack of adsorption by permeation of thermal expansion and the electrolytic solution, the electrostatic force of a sliding surface, and moisture and a sliding surface etc. Consequently, smooth sliding will be spoiled and the continuity of fuel supply will be spoiled.
[0008] Moreover, when the upper dashboard c slides, for example, granular metallic fuel is inserted between bottom edge [of the bottom hole a1 in the fuel container section a] a', and upper edge d' of the hole d1 in the upper dashboard d, or between upper edge b' of Areole b, and it is possible [it] that the upper dashboard d locks with this fuel-supply structure. This cause is because granular metallic fuel mainly adheres to that part with the dirt of a sliding surface. Thus, if a dashboard locks, a fuel will not be supplied superfluously or the output which was insufficient on the contrary and was stabilized will no longer be obtained.
[0009] This invention prevents the lock phenomenon by the granular metallic fuel in this sliding surface, and makes it the technical problem which should be solved to generate the output which supplied the fuel certainly quantitatively continuously and was stabilized while it plans seal function of the sliding surface in the movable quantum section which slides in order to carry out continuation supply of the fuel quantitatively, and smooth sliding nature.

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention] Since insulating solid-state lubricating film or an insulating rubber elasticity ingredient was used for the part which forms the sliding surface of the battery case section, the fuel container section or the battery case section and the fuel container section, and the movable quantum section according to this invention as stated above, while preventing adhesion of a granular fuel, leakage of the electrolytic solution, a steam, etc. can be prevented, consequently the sliding nature of the movable quantum section becomes good, and it is effective in securing the continuity of fuel supply. Moreover, it is effective in a lock phenomenon being avoidable with the elastic deformation of a rubber elasticity ingredient.

[Translation done.]

PRIOR ART

[Description of the Prior Art] A metal-air cell is a kind of primary cell which generates electricity combining reduction of the oxygen in an air pole, and the dissolution of the metal in a metal pole, and aluminum, iron, zinc, etc. are used for a metal pole. Drawing 9 shows the generation-of-electrical-energy principle of the metal-air cell which used aluminum for the metal pole, tabular carbon was used for the air pole, the whole surface touched air through ****** and, as for this air pole, other sides are immersed in the electrolytic solution. It is immersed in the electrolytic solution of KOH with which a metal pole belongs to an alkali-metal hydroxide.

[0003] And in an air pole, the reaction of 4O2+3 [3 /]/2H2 O+3e-->3OH- occurs, and the reaction of aluminum+3OH- ->aluminum(OH)3+3e- occurs on the metal pole. Therefore, an overall reaction becomes aluminum+3/2H2 O+3/4O2 - >aluminum(OH)3 **, and they are settlings (OH) aluminum 3. It remains.

[0004] In order to maintain such a cell reaction and to use it as a fuel cell, by circulating through the electrolytic solution, settlings are removed and the metal-air cell which constituted the metal pole from container-like porosity conductive material and granular metallic fuel continuously supplied into it is indicated by for example, the PCT/FR 91/No. 00944 publication. The fuel container section which has a bottom hole in this publication to the battery case section of the cel which **(ed) the metal pole which consists of a porous conductivity holder which established fuel intake up, and granular metallic fuel in it to the electrolytic-solution space formed of the tabular air pole which counters is upper-**(ed), and the thing in which the movable quantum section which supplies a fuel the whole constant rate between this cel and the fuel container section at a cel was made to infix is indicated. The quantum plate c in which the movable quantum section has concretely the areole b which hold temporarily the fuel of the quantum from the fuel container section a as shown in drawing 10 The upper dashboard d with the hole d1 which intervenes possible [both-way sliding] between the pars basilaris ossis occipitalis of the fuel container section a, and the above-mentioned quantum plate c, and opens the bottom hole a1 of the above-mentioned fuel container section a, and the areole b of the above-mentioned quantum plate c for free passage It intervenes possible [both-way sliding] between the above-mentioned quantum plate c and the top face which the fuel intake f of Cel e overlooks, and consists of a bottom dashboard g which had the hole g1 which opens the fuel intake f of the areole b of the above-mentioned quantum plate c, and Cel e for free passage.

[0005] Therefore, the fuel which the fuel intake f of Areole b and Cel e was open for free passage with sliding of the bottom dashboard g when the bottom hole of the fuel container section a and Areole b were open for free passage to the areole b of the quantum plate c with sliding of the upper dashboard d, the fuel of a quantum fell to Areole b, it was held and the fuel in Cel e decreased, and was held at Areole b falls in Cel e, and the metal pole h is supplied. If the fuel of Areole b is supplied to the metal pole h, after intercepting the fuel intake f of Areole b and Cel e by sliding of the bottom dashboard g, it slides on the upper dashboard d again, the fuel of the fuel container section a is held to Areole b, and it prepares for the next refueling. Thus, the fuel of a quantum will be continuously supplied to the metal pole h by mutual both-way sliding with the upper dashboard d and the bottom dashboard g.

[Translation done.]

MEANS

[Means for Solving the Problem] This invention possesses the porous wall which separates an air pole, this air pole, and predetermined spacing, and counters. It is formed between this air pole and this porous wall, is divided with this electrolytic-solution room with the electrolytic-solution room holding the electrolytic solution, the air chamber divided with this electrolytic-solution room by this air pole, and this porous wall, and has intake in the upper part. The battery case section which forms two or more single cels with the metal pole which contains the granular metallic fuel supplied from this intake, The fuel container section which is upper-**(ed) by this battery case section, has two or more fuel fall holes corresponding to said each fuel intake, and holds this granular metallic fuel, It is prepared between this fuel container section and the battery case section, and there are areole which carry out quantum maintenance of said granular metallic fuel which has opening which is open for free passage in the upper part on said each fuel fall way, and opening which is open for free passage to said each fuel intake at the lower part. The movable quantum section which displaces these areole in the condition of having made it intercepting with the condition of having made it open for free passage said fuel fall way and said fuel intake, coincidence, or by turns is provided. Furthermore, the part of both sliding surfaces with the movable quantum section, said fuel container section, and the battery case section which forms the whole surface at least is formed with insulating solid-state lubricating film or an insulating rubber elasticity ingredient.
[0011] The part which uses together solid-state lubricating film and a rubber elasticity ingredient, forms solid-state lubricating film in the whole surface of both sliding surfaces as a suitable mode, and forms other sides is formed with a rubber elasticity ingredient.

[Translation done.]

OPERATION

[Function] If a driving means is operated, the movable quantum section prepared between this fuel container section and the battery case section will slide on the metal-air cell of the above-mentioned configuration between the fuel container section and the battery case section, and it will supply granular metallic fuel to the metal pole of each ** cel. And since insulating solid-state lubricating film is formed in the part of both sliding surfaces with the movable quantum section, said fuel container section, and the battery case section which forms the whole surface at least, while adhesion of granular metallic fuel is prevented certainly, leakage of the electrolytic solution, a steam, etc. can be prevented. Consequently, sliding nature becomes good and the continuity of fuel supply is attained.
[0013] Moreover, in the case of a rubber elasticity ingredient, granular metallic fuel can be buried in the surface section of a rubber elasticity ingredient by the elastic deformation of a rubber elasticity ingredient, and sliding nature can be secured, and it can prevent a lock phenomenon. When using together solid-state lubricating film and a rubber elasticity ingredient, much more sliding nature is demonstrated with prevention of a lock phenomenon.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the metal-air cell used for the power source for an electric vehicle drive etc.
[0002]
[Description of the Prior Art] A metal-air cell is a kind of primary cell which generates electricity combining reduction of the oxygen in an air pole, and the dissolution of the metal in a metal pole, and aluminum, iron, zinc, etc. are used for a metal pole. Drawing 9 shows the generation-of-electrical-energy principle of the metal-air cell which used aluminum for the metal pole, tabular carbon was used for the air pole, the whole surface touched air through ****** and, as for this air pole, other sides are immersed in the electrolytic solution. It is immersed in the electrolytic solution of KOH with which a metal pole belongs to an alkali-metal hydroxide.
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[0004] In order to maintain such a cell reaction and to use it as a fuel cell, by circulating through the electrolytic solution, settlings are removed and the metal-air cell which constituted the metal pole from container-like porosity conductive material and granular metallic fuel continuously supplied into it is indicated by for example, the PCT/FR 91/No. 00944 publication. The fuel container section which has a bottom hole in this publication to the battery case section of the cel which **(ed) the metal pole which consists of a porous conductivity holder which established fuel intake up, and granular metallic fuel in it to the electrolytic-solution space formed of the tabular air pole which counters is upper-**(ed), and the thing in which the movable quantum section which supplies a fuel the whole constant rate between this cel and the fuel container section at a cel was made to infix is indicated. The quantum plate c in which the movable quantum section has concretely the areole b which hold temporarily the fuel of the quantum from the fuel container section a as shown in drawing 10 The upper dashboard d with the hole d1 which intervenes possible [both-way sliding] between the pars basilaris ossis occipitalis of the fuel container section a, and the above-mentioned quantum plate c, and opens the bottom hole a1 of the above-mentioned fuel container section a, and the areole b of the above-mentioned quantum plate c for free passage It intervenes possible [both-way sliding] between the above-mentioned quantum plate c and the top face which the fuel intake f of Cel e overlooks, and consists of a bottom dashboard g which had the hole g1 which opens the fuel intake f of the areole b of the above-mentioned quantum plate c, and Cel e for free passage.
[0005] Therefore, the fuel which the fuel intake f of Areole b and Cel e was open for free passage with sliding of the bottom dashboard g when the bottom hole of the fuel container section a and Areole b were open for free passage to the areole b of the quantum plate c with sliding of the upper dashboard d, the fuel of a quantum fell to Areole b, it was held and the fuel in Cel e decreased, and was held at Areole b falls in Cel e, and the metal pole h is supplied. If the fuel of Areole b is supplied to the metal pole h, after intercepting the fuel intake f of Areole b and Cel e by sliding of the bottom dashboard g, it slides on the upper dashboard d again, the fuel of the fuel container section a is held to Areole b, and it prepares for the next refueling. Thus, the fuel of a quantum will be continuously supplied to the metal pole h by mutual both-way sliding with the upper dashboard d and the bottom dashboard g.
[0006]
[Problem(s) to be Solved by the Invention] The fuel-supply structure in the conventional metal-air cell is a gestalt on which an upper dashboard slides between the fuel container section and a quantum plate, and a bottom dashboard slides between a quantum plate and the battery case section, and the smooth sliding nature of each dashboard is required of both sliding surfaces as the seal function which neither the electrolytic solution nor a steam reveals outside.
[0007] However, consideration is made by neither a seal function whose above-mentioned conventional fuel-supply structure was made to only intervene, and mentioned fats and oils i above, nor sliding nature. Therefore, while there is a

possibility that the electrolytic solution, a steam, etc. may be revealed outside, there is a possibility that aluminum powder may adhere to a sliding surface by the crack of adsorption by permeation of thermal expansion and the electrolytic solution, the electrostatic force of a sliding surface, and moisture and a sliding surface etc. Consequently, smooth sliding will be spoiled and the continuity of fuel supply will be spoiled.
[0008] Moreover, when the upper dashboard c slides, for example, granular metallic fuel is inserted between bottom edge [of the bottom hole a1 in the fuel container section a] a', and upper edge d' of the hole d1 in the upper dashboard d, or between upper edge b' of Areole b, and it is possible [it] that the upper dashboard d locks with this fuel-supply structure. This cause is because granular metallic fuel mainly adheres to that part with the dirt of a sliding surface. Thus, if a dashboard locks, a fuel will not be supplied superfluously or the output which was insufficient on the contrary and was stabilized will no longer be obtained.
[0009] This invention prevents the lock phenomenon by the granular metallic fuel in this sliding surface, and makes it the technical problem which should be solved to generate the output which supplied the fuel certainly quantitatively continuously and was stabilized while it plans seal function of the sliding surface in the movable quantum section which slides in order to carry out continuation supply of the fuel quantitatively, and smooth sliding nature.
[0010]
[Means for Solving the Problem] This invention possesses the porous wall which separates an air pole, this air pole, and predetermined spacing, and counters. It is formed between this air pole and this porous wall, is divided with this electrolytic-solution room with the electrolytic-solution room holding the electrolytic solution, the air chamber divided with this electrolytic-solution room by this air pole, and this porous wall, and has intake in the upper part. The battery case section which forms two or more single cels with the metal pole which contains the granular metallic fuel supplied from this intake, The fuel container section which is upper-**(ed) by this battery case section, has two or more fuel fall holes corresponding to said each fuel intake, and holds this granular metallic fuel, It is prepared between this fuel container section and the battery case section, and there are areole which carry out quantum maintenance of said granular metallic fuel which has opening which is open for free passage in the upper part on said each fuel fall way, and opening which is open for free passage to said each fuel intake at the lower part. The movable quantum section which displaces these areole in the condition of having made it intercepting with the condition of having made it open for free passage said fuel fall way and said fuel intake, coincidence, or by turns is provided. Furthermore, the part of both sliding surfaces with the movable quantum section, said fuel container section, and the battery case section which forms the whole surface at least is formed with insulating solid-state lubricating film or an insulating rubber elasticity ingredient.
[0011] The part which uses together solid-state lubricating film and a rubber elasticity ingredient, forms solid-state lubricating film in the whole surface of both sliding surfaces as a suitable mode, and forms other sides is formed with a rubber elasticity ingredient.
[0012]
[Function] If a driving means is operated, the movable quantum section prepared between this fuel container section and the battery case section will slide on the metal-air cell of the above-mentioned configuration between the fuel container section and the battery case section, and it will supply granular metallic fuel to the metal pole of each ** cel. And since insulating solid-state lubricating film is formed in the part of both sliding surfaces with the movable quantum section, said fuel container section, and the battery case section which forms the whole surface at least, while adhesion of granular metallic fuel is prevented certainly, leakage of the electrolytic solution, a steam, etc. can be prevented. Consequently, sliding nature becomes good and the continuity of fuel supply is attained.
[0013] Moreover, in the case of a rubber elasticity ingredient, granular metallic fuel can be buried in the surface section of a rubber elasticity ingredient by the elastic deformation of a rubber elasticity ingredient, and sliding nature can be secured, and it can prevent a lock phenomenon. When using together solid-state lubricating film and a rubber elasticity ingredient, much more sliding nature is demonstrated with prevention of a lock phenomenon.
[0014]
[Example] Hereafter, the example of illustration explains this invention to a detail.
Example 1 drawing 1 and drawing 2 show the metal-air cell concerning the 1st example of this invention. The metal-air cell of **** 1 example consists of the battery case section 3 which was installed in bottom outer container 1a formed in the cube type with the ceramic etc., and formed two or more single cels 2, the fuel container section 4 constituted by upper outer container 1b, the movable quantum section 5 constituted to the upper outer container 1b down side, and one driving means 6 which drives this movable quantum section 5.
[0015] The battery case section 3 is the aggregate of the two or more single cel 2 installed in the lengthwise direction (direction perpendicular to space) of an outer container 1 side by side. Each ** cel 2 is constituted by the parent in a frame 7. A frame 7 is a quadrilateral frame in which the field where a longitudinal direction counters has the side guide (figure abbreviation) which carries out opening and counters upper KAIDO 7a, bottom guide 7b, and a lengthwise direction. The slit-like opening 8 is formed in a lengthwise direction at upper guide 7a. The space for electrolytic-

solution paths is formed in bottom guide 7b. the air poles 11 and 11 respectively tabular to a lateral opposed face in each frame 7 -- means, such as adhesion, -- liquid -- it fixes densely. Cell space is formed of these air poles 11 and a frame 7, and the suspension of the container-like metal pole 12 is carried out to upper guide 7a so that the above-mentioned opening 8 and fuel intake 12a may be open for free passage in this each cell space. The electrolytic-solution room 9 is formed in the space of the metal pole 12 and each air pole 11, and when this electrolytic-solution room 9 is open for free passage with the space for electrolytic-solution paths in bottom guide 7b, this space for electrolytic-solution paths has become electrolytic-solution path 9a which opens the electrolytic-solution room 9 of each ** cel 2 for free passage. The electrolytic solution is supplied to this electrolytic-solution path 9a with the external circulation means outside drawing, and it can circulate now through the electrolytic solution. An air chamber 10 is formed of the space which each air pole 11 of the adjoining single cel 2 opposite-**(ed). The configuration of such the battery case section 3 is explained to the office reference number P000005670 which applied to coincidence at the detail.

[0016] In addition, even if the structure of the above-mentioned single cel 2 is not the structure which faced across the metal pole 12 by the air pole 11 from both sides like previous statement, one side may be a porous wall which only divides the electrolytic solution. Moreover, the air pole 11 is formed with carbon etc. The metal pole 12 is produced in the shape of a container in the porosity conductivity ingredient with which the electrolytic solution can permeate, is constituted to the electrolytic solution by the metal of corrosion resistance, for example, nickel, stainless steel, the iron that carried out nickel plating, and is located in the lengthwise direction between air poles 11 in the shape of a wall. And it is supplied to the metal pole 12 from the fuel container section 4 through the above-mentioned fuel intake 12a, the metallic fuel, for example, the aluminum fuel, of the diameter of 0.1-1.0mm.

[0017] in addition, the conductor of the pair which carries out sensing of the amount of an aluminum fuel inside one pinpointed metal pole 12 -- although the fuel detector by Pieces 14a and 14b is formed, explanation of this fuel detector is also indicated by the above-mentioned application at the detail. Next, the fuel container section 4 which arranged child-like pars-basilaris-ossis-occipitalis 4a of a reed screen in tabular, and carried out partition formation of the combustion chamber 15 is formed in the upper outer container 1b bottom. The slit-like fuel fall hole 17 is formed in the lengthwise direction which up opening by the side of a combustion chamber 15 and lower opening by the side of the movable quantum section 5 opened for free passage in child-like pars-basilaris-ossis-occipitalis 4a of this reed screen. For this fuel fall hole 17, a phase is half-pitch gap ****** to fuel intake 12a of the battery case section 3 while up opening is expanded to cross-section reverse trapezoidal shape and a rat tail and an aluminum fuel are easy to fall to a narrow diameter at a narrow diameter part to a lower opening side. Moreover, while the gas drainage hole 19 with which the wire gauze 18 was stuck is formed in head lining of upper outer container 1b, the fuel feed hopper 20 for supplying an aluminum fuel to a combustion chamber 15 is established.

[0018] Moreover, partition formation of the slide room 5a is carried out by the battery case section 3 and batch pars-basilaris-ossis-occipitalis 4b which opposite-**, and the movable quantum section 5 which comes to interpolate the quantum plate 22 in this slide room 5a is formed in the child-like pars-basilaris-ossis-occipitalis 4a bottom of the above-mentioned reed screen. It is [opening / lower] in agreement in fuel intake 12a of the single cel 2, and a phase (considering as the phase which visited the right end of fuel intake 12a correctly), and fuel pilot hole 4c which leads an aluminum fuel to fuel intake 12a is formed in batch pars-basilaris-ossis-occipitalis 4b. Up opening of this fuel pilot hole 4c is open for free passage to slide room 5a.

[0019] Reciprocation of the quantum plate 22 by which interpolation was carried out to slide room 5a in a longitudinal direction is enabled within this slide. Vertical opening is open for free passage, it can be open for free passage to fuel intake 12a of each ** cel 2 with reciprocation of this quantum plate 22 through the fuel fall hole 17 and fuel pilot hole 4c, and the areole 23 which carry out quantum maintenance of the aluminum fuel are formed in this quantum plate 22. The motor of direct-acting is used, the output-shaft 6a penetrates the flank of upper outer container 1b, and the driving means 6 which makes the quantum plate 22 reciprocate is connected to the quantum plate 22.

[0020] Here, in order not to make the electrolytic solution, a steam, etc. reveal to the exterior through the plane of composition of upper outer container 1b and bottom outer container 1a, film 21a by insulating solid lubricants, such as boron nitride powder and PTFE powder, is formed in the base of upper outer container 1b of spreading or spraying. Moreover, except for the effective area of the fuel fall hole 17 and fuel pilot hole 4c, the same insulating solid-state lubricating film 21b and 21c as the base of upper outer container 1b is formed in each slide contact side with the top wall of slide room 5a and bottom wall in the quantum plate 22, respectively.

[0021] Thus, the metal-air cell of the 1st constituted example operates as follows. An air pole 11 and the metal pole 12 perform a discharge operation of a cell by reaction formula which was mentioned already, and the aluminum fuel of the metal pole 12 is consumed by discharge. And if the aluminum fuels in the pinpointed metal pole 12 decrease in number from the fuel quantity set up beforehand The areole 23 which double action (it moves in the direction of A) of the quantum plate 22 is carried out by the driving means 6, and are shown in drawing 2 (B) like drawing 2 (A) from the fuel fall hole 17 and the condition which was open for free passage It displaces in the condition that areole 23 were open for free passage to fuel intake 12a through fuel pilot hole 4c, and the aluminum fuel of the amount held to areole

23 is supplied to each metal pole 12. the conductor which prepared such double action of the quantum plate 22 in the metal pole 12 -- it is because the actuation command of the driving means 6 is carried out by Pieces 14a and 14b by making to detect reduction in a fuel into a trigger.
[0022] By the way, in the above-mentioned example, since insulating solid-state lubricating film 21b and 21c is formed in the vertical sliding surface of the quantum plate 22, while adhesion of the aluminum fuel to a sliding surface is prevented certainly, leakage of the electrolytic solution, a steam, etc. can be prevented. Consequently, while securing the smooth sliding nature of the quantum plate 22, the grain of aluminum adheres to neither the opening edge of areole 23, nor the opening edge of the fuel fall hole 17, and the lock phenomenon of the quantum plate 22 is prevented. Moreover, insulating solid-state lubricating film 21a formed in the base of upper outer container 1b prevents the leakage to the exterior of the electrolytic solution or a steam. The metal-air cell which adopts this example in this way can perform a stable generation of electrical energy. In addition, when making each outer containers 1a and 1b into one, insulating solid-state lubricating film 21a may omit.
[0023] Example 2 drawing 4 shows the metal-air cell concerning the 2nd example of this invention. Although the point which constitutes the battery case section 3 this example of whose is the aggregate of the single cel 2 in bottom outer container 1a is the same as the 1st example, the movable quantum section 5 is omitted and the fuel container section 4 constituted by upper outer container 1b is made to reciprocate directly. That is, the fuel fall hole 17 is formed in child-like pars-basilaris-ossis-occipitalis 4a of the reed screen which ****s in the battery case section 3 of upper outer container 1b corresponding to each ** cel 2, and a combustion chamber 15 is formation, now ****** between child-like pars-basilaris-ossis-occipitalis 4a of this reed screen, and head lining. In this case, thickness of the pars basilaris ossis occipitalis 2 which secures quantum fall of a fuel is made larger than a last example, and the path of the fuel fall hole 17 is lengthened. Thereby, the fuel fall hole 17 achieves the same function as areole 23.
[0024] And in this example, 21d of insulating solid-state lubricating film is formed in the base except the fuel fall hole 17 of the above-mentioned fuel container section 4. Therefore, while adhesion of the aluminum fuel to a sliding surface is prevented certainly and the smooth sliding nature of the sliding surface of the fuel container section 4 and the battery case section 3 is secured also in this example, external leakage of the electrolytic solution from this sliding surface or a steam can be prevented.
[0025] Example 3 drawing 4 and drawing 5 show the metal-air cell concerning the 3rd example of this invention. An outer container 1 is really elegance, and this example constitutes the battery case section 3 to that down side, and constitutes the fuel container section 4 to the up side. And to the top face of the battery case section 3, child-like pars-basilaris-ossis-occipitalis 4a of the reed screen of this fuel container section 4 opens spacing of slide room 5a, and is formed, and interpolation of the quantum plate 22 which has areole 23 in this slide room 5a is carried out. The description of this example carries out the seal of the vertical sliding surface of the quantum plate 22 except vertical edge opening of areole 23 with the spring materials 24a and 24b, such as rubber, respectively, and forms insulating solid-state lubricating film 21e and 21f in the ****** sliding surface of slide room 5a which ****s to this vertical sliding surface.
[0026] In addition, at this example, slide room 5a is open for free passage with the exterior from the 1 side by the side of longitudinal direction opposite of an outer container 1, and ******** as sampling of the quantum plate 22 is possible. In addition, 25 is a stopper. According to such an example, with the solid-state lubricating film 21e and 21f of fuel container section insulation, while being able to prevent adhesion of an aluminum fuel Although the upper limit opening edge of areole 23 and the lower limit opening edge of the fuel fall hole 17 sandwich an aluminum grain as external leakage of the electrolytic solution or a steam is prevented and it is further shown in drawing 5 for example This aluminum grain aluminum is buried in the surface section of rubber elasticity ingredient 24a by the elastic deformation of rubber elasticity ingredient 24a, sliding nature is not worsened, and a lock phenomenon can be avoided.
[0027] The metal-fuel cell shown in example 4 drawing 6 - drawing 8 makes the quantum plate 22 of the 1st example a roller gestalt. That is, this 4th example really which unified two or more frames 7 used as child-like pars-basilaris-ossis-occipitalis 4a of the reed screen of the fuel container section 4, and the parent of each ** cel 2 makes a form the battery case section 3 and the fuel container section 4 really by the frame 16. And the fuel path equivalent to the fuel fall hole 17 Cover the part used as child-like pars-basilaris-ossis-occipitalis 4a of a reed screen, and the part used as upper guide 7a, and bordering on the roller-type quantum plate 22 mentioned later Fall hole 17a above it, It is formed in a vertical by lower fall hole 17b, upper limit opening of fall hole 17a is open for free passage to a combustion chamber 15, and lower limit opening of fall hole 17b is opened for free passage by fuel intake 12a of each ** cel 2.
[0028] Each roller-type quantum plate 22 is infixed the fall holes 17a and 17b and a free passage are free, and free [axial rotation in the tubiform hole 26 of the lengthwise direction formed in the boundary with nothing and the fall holes 17a and 17b in the shape of a long cylinder with **** 23' which passes along a shaft]. Moreover, each roller type quantum plate 22 is connected with belt 6b by which one edge each was constructed over the outside of an outer container 1 by a projection and projected roller section 22A at forward inverse rotation output-shaft 6a of a driving means 6, and the fixed roller 29, respectively, as shown in drawing 7 . Thereby, the rotation drive of the roller-type

quantum plate 22 is carried out by the driving means 6.
[0029] Furthermore, each roller-type quantum plate 22 of this example is formed with the rubber elasticity ingredient. On the other hand, 21g of insulating solid-state lubricating film is formed in the frame wall surface of the above-mentioned tubiform hole 26. Therefore, in the case of the 4th example of the above, the variation rate of each roller-type quantum plate 22 can be changed into the condition of having made **** 23' in agreement with fall hole 17a and fall hole 17b, and the condition that **** 23' becomes a cross joint to the fuel path of fall hole 17a and fall hole 17b as shown in drawing 6 , by the rotational motion of a driving means 6. Thereby, according to fuel consumption, an aluminum fuel can be continuously supplied to each ** cel 2.
[0030] Moreover, although, as for this example, the opening edge of **** 23' and the opening edge of the fall holes 17a and 17b sandwich the aluminum grain aluminum as shown in drawing 8 , like the 3rd example, by the elastic deformation of quantum plate 22 the very thing of a roller type, the aluminum grain aluminum can be buried in the surface section of a rubber elasticity ingredient, and can prevent a lock phenomenon.
[0031]
[Effect of the Invention] Since insulating solid-state lubricating film or an insulating rubber elasticity ingredient was used for the part which forms the sliding surface of the battery case section, the fuel container section or the battery case section and the fuel container section, and the movable quantum section according to this invention as stated above, while preventing adhesion of a granular fuel, leakage of the electrolytic solution, a steam, etc. can be prevented, consequently the sliding nature of the movable quantum section becomes good, and it is effective in securing the continuity of fuel supply. Moreover, it is effective in a lock phenomenon being avoidable with the elastic deformation of a rubber elasticity ingredient.

[Translation done.]

EXAMPLE

[Example] Hereafter, the example of illustration explains this invention to a detail.
Example 1 drawing 1 and drawing 2 show the metal-air cell concerning the 1st example of this invention. The metal-air cell of **** 1 example consists of the battery case section 3 which was installed in bottom outer container 1a formed in the cube type with the ceramic etc., and formed two or more single cels 2, the fuel container section 4 constituted by upper outer container 1b, the movable quantum section 5 constituted to the upper outer container 1b down side, and one driving means 6 which drives this movable quantum section 5.
[0015] The battery case section 3 is the aggregate of the two or more single cel 2 installed in the lengthwise direction (direction perpendicular to space) of an outer container 1 side by side. Each ** cel 2 is constituted by the parent in a frame 7. A frame 7 is a quadrilateral frame in which the field where a longitudinal direction counters has the side guide (figure abbreviation) which carries out opening and counters upper KAIDO 7a, bottom guide 7b, and a lengthwise direction. The slit-like opening 8 is formed in a lengthwise direction at upper guide 7a. The space for electrolytic-solution paths is formed in bottom guide 7b. the air poles 11 and 11 respectively tabular to a lateral opposed face in each frame 7 -- means, such as adhesion, -- liquid -- it fixes densely. Cell space is formed of these air poles 11 and a frame 7, and the suspension of the container-like metal pole 12 is carried out to upper guide 7a so that the above-mentioned opening 8 and fuel intake 12a may be open for free passage in this each cell space. The electrolytic-solution room 9 is formed in the space of the metal pole 12 and each air pole 11, and when this electrolytic-solution room 9 is open for free passage with the space for electrolytic-solution paths in bottom guide 7b, this space for electrolytic-solution paths has become electrolytic-solution path 9a which opens the electrolytic-solution room 9 of each ** cel 2 for free passage. The electrolytic solution is supplied to this electrolytic-solution path 9a with the external circulation means outside drawing, and it can circulate now through the electrolytic solution. An air chamber 10 is formed of the space which each air pole 11 of the adjoining single cel 2 opposite-**(ed). The configuration of such the battery case section 3 is explained to the office reference number P000005670 which applied to coincidence at the detail.
[0016] In addition, even if the structure of the above-mentioned single cel 2 is not the structure which faced across the metal pole 12 by the air pole 11 from both sides like previous statement, one side may be a porous wall which only divides the electrolytic solution. Moreover, the air pole 11 is formed with carbon etc. The metal pole 12 is produced in the shape of a container in the porosity conductivity ingredient with which the electrolytic solution can permeate, is constituted to the electrolytic solution by the metal of corrosion resistance, for example, nickel, stainless steel, the iron that carried out nickel plating, and is located in the lengthwise direction between air poles 11 in the shape of a wall. And it is supplied to the metal pole 12 from the fuel container section 4 through the above-mentioned fuel intake 12a, the metallic fuel, for example, the aluminum fuel, of the diameter of 0.1-1.0mm.
[0017] in addition, the conductor of the pair which carries out sensing of the amount of an aluminum fuel inside one pinpointed metal pole 12 -- although the fuel detector by Pieces 14a and 14b is formed, explanation of this fuel detector is also indicated by the above-mentioned application at the detail. Next, the fuel container section 4 which arranged child-like pars-basilaris-ossis-occipitalis 4a of a reed screen in tabular, and carried out partition formation of the combustion chamber 15 is formed in the upper outer container 1b bottom. The slit-like fuel fall hole 17 is formed in the lengthwise direction which up opening by the side of a combustion chamber 15 and lower opening by the side of the movable quantum section 5 opened for free passage in child-like pars-basilaris-ossis-occipitalis 4a of this reed screen. For this fuel fall hole 17, a phase is half-pitch gap ****** to fuel intake 12a of the battery case section 3 while up opening is expanded to cross-section reverse trapezoidal shape and a rat tail and an aluminum fuel are easy to fall to a narrow diameter at a narrow diameter part to a lower opening side. Moreover, while the gas drainage hole 19 with which the wire gauze 18 was stuck is formed in head lining of upper outer container 1b, the fuel feed hopper 20 for supplying an aluminum fuel to a combustion chamber 15 is established.
[0018] Moreover, partition formation of the slide room 5a is carried out by the battery case section 3 and batch pars-basilaris-ossis-occipitalis 4b which opposite-**, and the movable quantum section 5 which comes to interpolate the quantum plate 22 in this slide room 5a is formed in the child-like pars-basilaris-ossis-occipitalis 4a bottom of the

above-mentioned reed screen. It is [opening / lower] in agreement in fuel intake 12a of the single cel 2, and a phase (considering as the phase which visited the right end of fuel intake 12a correctly), and fuel pilot hole 4c which leads an aluminum fuel to fuel intake 12a is formed in batch pars-basilaris-ossis-occipitalis 4b. Up opening of this fuel pilot hole 4c is open for free passage to slide room 5a.

[0019] Reciprocation of the quantum plate 22 by which interpolation was carried out to slide room 5a in a longitudinal direction is enabled within this slide. Vertical opening is open for free passage, it can be open for free passage to fuel intake 12a of each ** cel 2 with reciprocation of this quantum plate 22 through the fuel fall hole 17 and fuel pilot hole 4c, and the areole 23 which carry out quantum maintenance of the aluminum fuel are formed in this quantum plate 22. The motor of direct-acting is used, the output-shaft 6a penetrates the flank of upper outer container 1b, and the driving means 6 which makes the quantum plate 22 reciprocate is connected to the quantum plate 22.

[0020] Here, in order not to make the electrolytic solution, a steam, etc. reveal to the exterior through the plane of composition of upper outer container 1b and bottom outer container 1a, film 21a by insulating solid lubricants, such as boron nitride powder and PTFE powder, is formed in the base of upper outer container 1b of spreading or spraying. Moreover, except for the effective area of the fuel fall hole 17 and fuel pilot hole 4c, the same insulating solid-state lubricating film 21b and 21c as the base of upper outer container 1b is formed in each slide contact side with the top wall of slide room 5a and bottom wall in the quantum plate 22, respectively.

[0021] Thus, the metal-air cell of the 1st constituted example operates as follows. An air pole 11 and the metal pole 12 perform a discharge operation of a cell by reaction formula which was mentioned already, and the aluminum fuel of the metal pole 12 is consumed by discharge. And if the aluminum fuels in the pinpointed metal pole 12 decrease in number from the fuel quantity set up beforehand The areole 23 which double action (it moves in the direction of A) of the quantum plate 22 is carried out by the driving means 6, and are shown in drawing 2 (B) like drawing 2 (A) from the fuel fall hole 17 and the condition which was open for free passage It displaces in the condition that areole 23 were open for free passage to fuel intake 12a through fuel pilot hole 4c, and the aluminum fuel of the amount held to areole 23 is supplied to each metal pole 12. the conductor which prepared such double action of the quantum plate 22 in the metal pole 12 -- it is because the actuation command of the driving means 6 is carried out by Pieces 14a and 14b by making to detect reduction in a fuel into a trigger.

[0022] By the way, in the above-mentioned example, since insulating solid-state lubricating film 21b and 21c is formed in the vertical sliding surface of the quantum plate 22, while adhesion of the aluminum fuel to a sliding surface is prevented certainly, leakage of the electrolytic solution, a steam, etc. can be prevented. Consequently, while securing the smooth sliding nature of the quantum plate 22, the grain of aluminum adheres to neither the opening edge of areole 23, nor the opening edge of the fuel fall hole 17, and the lock phenomenon of the quantum plate 22 is prevented. Moreover, insulating solid-state lubricating film 21a formed in the base of upper outer container 1b prevents the leakage to the exterior of the electrolytic solution or a steam. The metal-air cell which adopts this example in this way can perform a stable generation of electrical energy. In addition, when making each outer containers 1a and 1b into one, insulating solid-state lubricating film 21a may omit.

[0023] Example 2 drawing 4 shows the metal-air cell concerning the 2nd example of this invention. Although the point which constitutes the battery case section 3 this example of whose is the aggregate of the single cel 2 in bottom outer container 1a is the same as the 1st example, the movable quantum section 5 is omitted and the fuel container section 4 constituted by upper outer container 1b is made to reciprocate directly. That is, the fuel fall hole 17 is formed in child-like pars-basilaris-ossis-occipitalis 4a of the reed screen which ****s in the battery case section 3 of upper outer container 1b corresponding to each ** cel 2, and a combustion chamber 15 is formation, now ****** between child-like pars-basilaris-ossis-occipitalis 4a of this reed screen, and head lining. In this case, thickness of the pars basilaris ossis occipitalis 2 which secures quantum fall of a fuel is made larger than a last example, and the path of the fuel fall hole 17 is lengthened. Thereby, the fuel fall hole 17 achieves the same function as areole 23.

[0024] And in this example, 21d of insulating solid-state lubricating film is formed in the base except the fuel fall hole 17 of the above-mentioned fuel container section 4. Therefore, while adhesion of the aluminum fuel to a sliding surface is prevented certainly and the smooth sliding nature of the sliding surface of the fuel container section 4 and the battery case section 3 is secured also in this example, external leakage of the electrolytic solution from this sliding surface or a steam can be prevented.

[0025] Example 3 drawing 4 and drawing 5 show the metal-air cell concerning the 3rd example of this invention. An outer container 1 is really elegance, and this example constitutes the battery case section 3 to that down side, and constitutes the fuel container section 4 to the up side. And to the top face of the battery case section 3, child-like pars-basilaris-ossis-occipitalis 4a of the reed screen of this fuel container section 4 opens spacing of slide room 5a, and is formed, and interpolation of the quantum plate 22 which has areole 23 in this slide room 5a is carried out. The description of this example carries out the seal of the vertical sliding surface of the quantum plate 22 except vertical edge opening of areole 23 with the spring materials 24a and 24b, such as rubber, respectively, and forms insulating solid-state lubricating film 21e and 21f in the ****** sliding surface of slide room 5a which ****s to this vertical

sliding surface.
[0026] In addition, at this example, slide room 5a is open for free passage with the exterior from the 1 side by the side of longitudinal direction opposite of an outer container 1, and ******** as sampling of the quantum plate 22 is possible. In addition, 25 is a stopper. According to such an example, with the solid-state lubricating film 21e and 21f of fuel container section insulation, while being able to prevent adhesion of an aluminum fuel Although the upper limit opening edge of areole 23 and the lower limit opening edge of the fuel fall hole 17 sandwich an aluminum grain as external leakage of the electrolytic solution or a steam is prevented and it is further shown in drawing 5 for example This aluminum grain aluminum is buried in the surface section of rubber elasticity ingredient 24a by the elastic deformation of rubber elasticity ingredient 24a, sliding nature is not worsened, and a lock phenomenon can be avoided.
[0027] The metal-fuel cell shown in example 4 drawing 6 - drawing 8 makes the quantum plate 22 of the 1st example a roller gestalt. That is, this 4th example really which unified two or more frames 7 used as child-like pars-basilaris-ossis-occipitalis 4a of the reed screen of the fuel container section 4, and the parent of each ** cel 2 makes a form the battery case section 3 and the fuel container section 4 really by the frame 16. And the fuel path equivalent to the fuel fall hole 17 Cover the part used as child-like pars-basilaris-ossis-occipitalis 4a of a reed screen, and the part used as upper guide 7a, and bordering on the roller-type quantum plate 22 mentioned later Fall hole 17a above it, It is formed in a vertical by lower fall hole 17b, upper limit opening of fall hole 17a is open for free passage to a combustion chamber 15, and lower limit opening of fall hole 17b is opened for free passage by fuel intake 12a of each ** cel 2.
[0028] Each roller-type quantum plate 22 is infixed the fall holes 17a and 17b and a free passage are free, and free [axial rotation in the tubiform hole 26 of the lengthwise direction formed in the boundary with nothing and the fall holes 17a and 17b in the shape of a long cylinder with **** 23' which passes along a shaft]. Moreover, each roller type quantum plate 22 is connected with belt 6b by which one edge each was constructed over the outside of an outer container 1 by a projection and projected roller section 22A at forward inverse rotation output-shaft 6a of a driving means 6, and the fixed roller 29, respectively, as shown in drawing 7 . Thereby, the rotation drive of the roller-type quantum plate 22 is carried out by the driving means 6.
[0029] Furthermore, each roller-type quantum plate 22 of this example is formed with the rubber elasticity ingredient. On the other hand, 21g of insulating solid-state lubricating film is formed in the frame wall surface of the above-mentioned tubiform hole 26. Therefore, in the case of the 4th example of the above, the variation rate of each roller-type quantum plate 22 can be changed into the condition of having made **** 23' in agreement with fall hole 17a and fall hole 17b, and the condition that **** 23' becomes a cross joint to the fuel path of fall hole 17a and fall hole 17b as shown in drawing 6 , by the rotational motion of a driving means 6. Thereby, according to fuel consumption, an aluminum fuel can be continuously supplied to each ** cel 2.
[0030] Moreover, although, as for this example, the opening edge of **** 23' and the opening edge of the fall holes 17a and 17b sandwich the aluminum grain aluminum as shown in drawing 8 , like the 3rd example, by the elastic deformation of quantum plate 22 the very thing of a roller type, the aluminum grain aluminum can be buried in the surface section of a rubber elasticity ingredient, and can prevent a lock phenomenon.

[Translation done.]